

By a suitable course of experiment, the proportions of the several salts present were found to be nearly thus :

Sulphate of potash.....	71
Sulphate of soda.....	19
Muriate of soda	5

the remainder consisting of a little muriate of ammonia, mixed with the muriates of iron and copper.

In the part which remained undissolved by water, there was also found to be submuriate of copper, similar in composition to the green sand of Peru, and a yellow powder that was judged to be submuriate of iron ; so that, on the whole, this single mass presented as many as nine different species of matter.

Some Experiments and Observations on the Substances produced in different chemical Processes on Fluor Spar. By Sir Humphry Davy, LL.D. F.R.S. V.P.R.I. Read July 8, 1813. [*Phil. Trans.* 1813, p. 263.]

In the Bakerian lecture for 1808, the author had supposed fluor acid to be decomposed when potassium is heated in silicated fluoric acid gas, and that oxygen was separated from it ; an inference which had also been drawn from a similar experiment by Messrs. Gay-Lussac and Thenard. But when he afterwards found that oxymuriatic acid could not be decomposed, and that no oxygen could be separated from the compounds of this body with phosphorus, sulphur, or the metals, he was led to conceive an analogy between the oxymuriatic and fluoric compounds, an analogy also suggested to him by M. Ampere.

The experiments described in the present paper are principally guided by this analogy, with a view to ascertain whether it is well founded.

The subjects of experiment are silicated fluoric gas, originally discovered by Scheele. Liquid fluoric acid in its concentrated state, first obtained by Messrs. Gay-Lussac and Thenard, and the fluo-boric acid of the same chemists.

When these compounds are acted upon by potassium or sodium, the results are fluates of potash or soda, with silicum, hydrogen, or boron, according to the compound operated upon.

With regard to these results, there are three hypotheses which may be maintained. One is, that fluoric acid consists of an inflammable base united to oxygen. A second, that it consists of a simple base, which may be called fluorine (analogous to chlorine), united with hydrogen. A third is, according to the tenets of the phlogistians, that fluoric acid, like metallic oxides, is liable to combine with hydrogen, and form an inflammable compound. Since all the phenomena may be explained according to any one or other of these hypotheses, the sole question is, which of these explanations is best, as being most conformable to the general series of chemical facts with which we are at present acquainted.

Sulphuric and nitric acids which, according to the first supposition, are inflammable bases combined with oxygen and water, when acted upon by ammonia yield water, but fluoric acid in combining with ammonia gives out no water.

Sulphate of ammonia, by the action of potassium, yields sulphur and ammonia; and in the same manner nitrate of ammonia yields its base azote, with ammonia. But when fluat of ammonia is acted upon by potassium, the only product beside ammonia is hydrogen, just as in the action of potassium upon muriate of ammonia, which yields only hydrogen and ammonia. In the latter case chlorine combines with the potassium; and it would appear that a similar base is contained in the fluat of ammonia.

By the voltaic battery also, hydrates of such bodies as are known to contain oxygen, as sulphuric acid, hydrophosphorous acid, and nitric acid, all yield oxygen at the positive wire, and at the negative they give out their base, or a suboxide, along with hydrogen.

The strong action of fluoric acid on almost all bodies, occasioned considerable difficulty in attempting to collect the products of its electrization. But in a tube of horn silver, when it was electrified by a wire of platina at the positive pole, the wire was covered with a chocolate-coloured powder, but no oxygen was extricated.

When a piece of plumbago was placed as the positive conductor in fluoric acid, it was quickly destroyed, and a subfluat of iron was deposited at the negative surface, the fluid becoming turbid and black.

These and other phenomena of electrization appear to the author not favourable to the supposition of fluoric acid consisting of an inflammable base combined with oxygen; but to be best explained by supposing it to be, like muriatic acid, composed of hydrogen, which appears at the negative pole, and a peculiar principle to be termed fluorine, which, like chlorine, is negative, and is attracted by the positive pole, and in general combines with the metal, which is there exposed to its action.

If, then, according to this supposition, we assume that fluates are combustibles united with fluorine, this principle cannot be obtained separate by means of any other combustible, as these will only form new compounds with it; but we may hope to effect the separation by means of oxygen or chlorine; as these in certain cases separate each other. And since the fluates of silver, mercury, and potash, are decomposed by *muriatic acid*, the author exposed these compounds also to the action of chlorine, in the hope that fluorine might by that means be disengaged.

But though these fluates were each decomposed, the matter separated from them acted upon the vessels containing them with too much energy to be exhibited in a separate state.

There seems, however, says the author, great reason to suppose that a particular principle *is* separated from them analogous to chlorine, and that when it can be obtained separate, it will be found to be a gaseous body.

He estimates the number which should represent fluorine at less

than half that of chlorine, and so little exceeding that of oxygen, that those who would suppose it to contain oxygen combined with an inflammable base, must suppose the base to be less than one twentieth part of the oxygen with which it combines.

Catalogue of North Polar Distances of Eighty-four principal fixed Stars, deduced from Observations made with the Mural Circle at the Royal Observatory. By John Pond, Esq. Astronomer Royal, F.R.S. Read July 8, 1813. [Phil. Trans. 1813, p. 280.]

A Synoptic Scale of Chemical Equivalents. By William Hyde Wollaston, M.D. Sec. R.S. Read November 4, 1813. [Phil. Trans. 1814, p. 1.]

The design of the scale here proposed by the author is to save chemists the labour of many troublesome computations in estimating the ingredients of neutral salts, and the reagents and precipitates by which these ingredients might be ascertained.

For though certain laws to which chemical union is subjected have of late been discovered, and have enabled chemists to determine with greater precision than formerly the composition of bodies submitted to be examined, and to express numerically the relation of the several elementary chemical substances to each other; nevertheless the computations requisite for applying these results to many objects of inquiry are frequently attended with considerable trouble.

The author briefly sketches the history of proportional chemistry, beginning with Bergman, who, perceiving that the same acid united to the same base, always in the same proportion, took pains to ascertain the composition of various salts. Kirwan followed the same line of endeavour to a greater extent, with a view to determine the proportions of various acids to different bases, as questions independent of each other. To these succeeded Richter, who gave connection to the subject by observing a new relation that had escaped the notice of Bergman, Kirwan, or any of his predecessors. They had observed only the constancy of the proportion of the same acid to the same base; Richter observed, further, a fixed relation of acid to acid: namely, that when the proportional quantities of any two acids, that are each sufficient to saturate a given quantity of any one base is determined, the same proportional weights of these acids will also saturate equal quantities of any other base; and consequently that if any quantity of sulphuric acid be assumed as standard, then equivalent quantities of all other acids may be conveniently expressed by fixed numbers, adapted to each; and the several quantities of different alkalies and earths that would each saturate the standard quantity, might also be represented constantly by corresponding numbers.

The observation of other proportions, which are simple multiples of the preceding, by Mr. Dalton and others, are noticed as affording an important correction of the best analyses; but it is observed that